Write your name here

| Surname | Other names |
|---|---|
| | |

**Pearson Edexcel**
**International**
**Advanced Level**

Centre Number | | | | | |

Candidate Number | | | | |

# Biology

## Advanced

## Unit 4: The Natural Environment and Species Survival

Thursday 16 June 2016 – Afternoon
**Time: 1 hour 30 minutes**

Paper Reference
**WBI04/01**

**You must have:**
Ruler, calculator

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

### Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*

### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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P 4 6 6 4 5 A 0 1 2 4

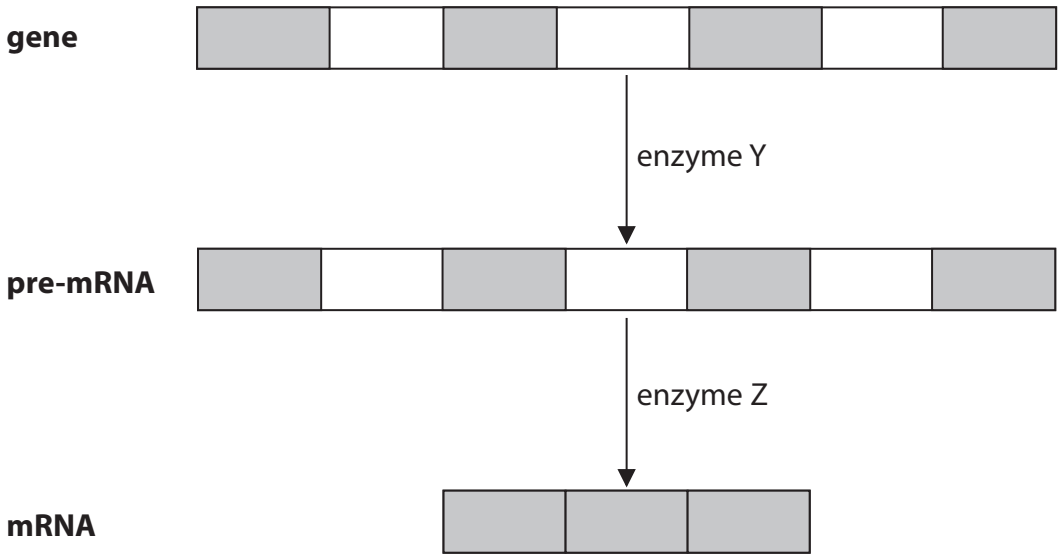
PEARSON

**Answer ALL questions.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

**1** A number of different enzymes are involved in the synthesis of mRNA and polypeptides.

(a) The diagram below shows two steps involved in the synthesis of a polypeptide.




(i) Place a cross ☒ in the box that completes the following statement.

An enzyme is

**(1)**

☒ **A** a fibrous protein

☒ **B** a globular protein

☒ **C** a saturated fatty acid

☒ **D** an unsaturated fatty acid

(ii) Place a cross ☒ in the box that completes the following statement.

An enzyme is a molecule that

**(1)**

☒ **A** decreases the activation energy of a metabolic reaction and decreases reaction time

☒ **B** decreases the activation energy of a metabolic reaction and increases reaction time

☒ **C** increases the activation energy of a metabolic reaction and decreases reaction time

☒ **D** increases the activation energy of a metabolic reaction and increases reaction time

(iii) Name the enzyme Y.

**(1)**

.....

(iv) State the role of enzyme Z.

**(1)**

.....

.....

(v) Name the parts of the pre-mRNA molecule, represented by the shaded areas in the diagram.

**(1)**

(vi) A gene may be defined as a length of DNA coding for one polypeptide chain.

Using the information in the diagram, explain why this definition does **not** apply to this gene.

**(4)**

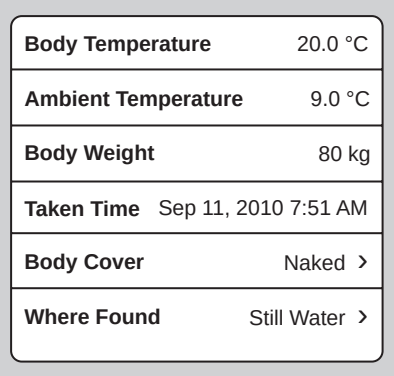
(b) Describe how the polypeptide chain is synthesised from the mRNA.

**(4)**

**(Total for Question 1 = 13 marks)**

***2** There are apps (computer software) available on some smartphones that can calculate the time of death of a person.

The image below is from the screen of a smartphone with some information that has been put into this app when a body was found.




Explain why the information required by this app is needed to calculate the time of death of this body.

**(6)**

**(Total for Question 2 = 6 marks)**

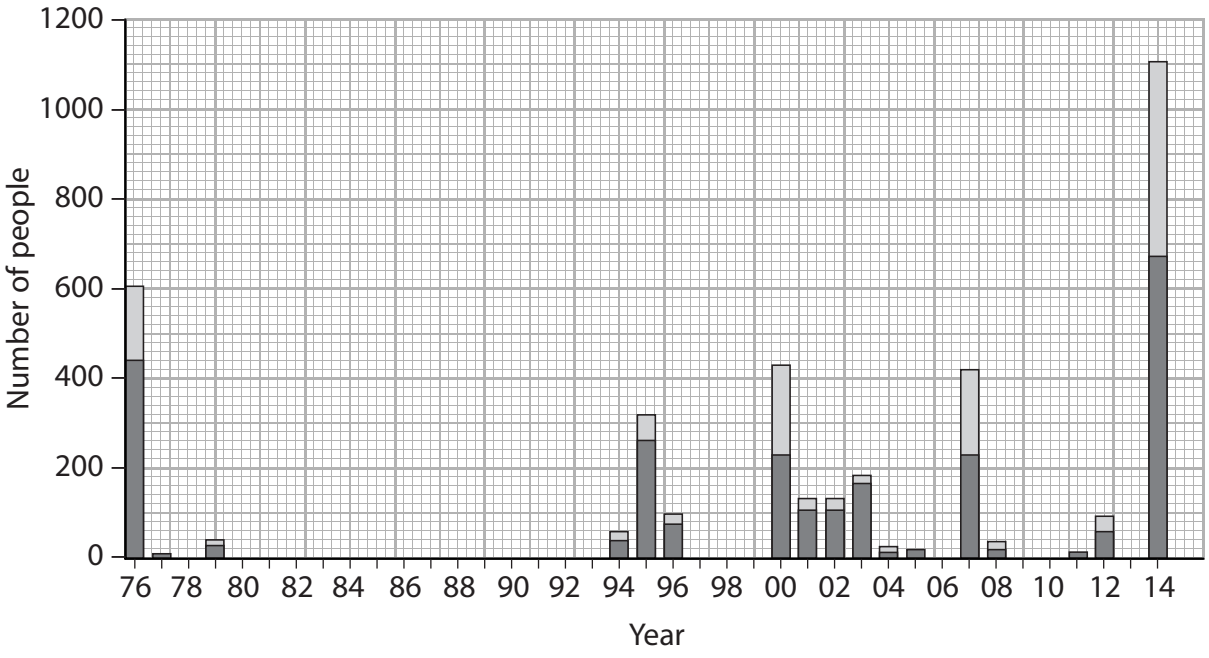
**3** Ebola virus disease (EVD) in humans is caused by the Ebola virus.

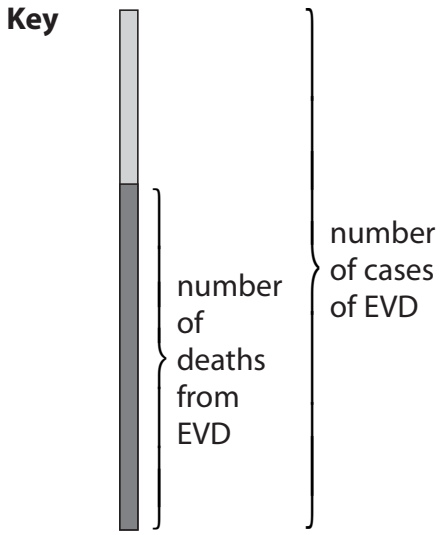
(a) Describe the structure of a virus.

**(2)**

(b) There was an outbreak of EVD in Liberia in 2014.

The graph below shows the number of EVD cases and the number of deaths from this disease, in Liberia, from 1976 until 2014.



(i) Using the information in the graph, calculate the percentage of people with EVD who died in 2014.

Show your working.

**(2)**

Answer ..... %

(ii) EVD is fatal in up to 90% of cases.

Suggest why the calculated value for 2014 is below 90%.

**(2)**

.....

.....

.....

.....

.....

.....

(c) In 2014, there were no available drugs or licensed vaccines for EVD. Vaccines were being developed and were undergoing clinical trials.

(i) Using the information in the graph, suggest why vaccines for EVD were not developed earlier.

**(1)**

(ii) Describe the methods used to test new drugs in humans.

**(3)**

(iii) Drugs are being developed that contain either interferon or chemicals that interfere with viral replication.

Suggest how these drugs could prevent the development of EVD in humans.

**(3)**

**(Total for Question 3 = 13 marks)**

**4** Colostrum is a form of milk. Colostrum is produced by mammals to feed their newborn babies for a few days after birth.

The table below shows some of the classes of antibody in human and in bovine colostrum (colostrum from cows).

| Class of antibody | Antibody concentration in human colostrum / mg $cm^{-3}$ | Antibody concentration in bovine colostrum / mg $cm^{-3}$ |
|---|---|---|
| IgA | 17.4 | 3.9 |
| IgG | 0.4 | 47.6 |
| IgG2 | 0.0 | 2.9 |

(a) (i) Place a cross ☒ in the box next to the cell that releases antibodies.

**(1)**

☒ **A** helper T cell

☒ **B** killer T cell

☒ **C** macrophage

☒ **D** plasma cell

(ii) Place a cross ☒ in the box that completes the following statement.

An antibody has

**(1)**

☒ **A** one antigen binding site and one binding site for macrophages

☒ **B** one antigen binding site and two binding sites for macrophages

☒ **C** two antigen binding sites and one binding site for macrophages

☒ **D** two antigen binding sites and two binding sites for macrophages

(iii) Using the information in the table, compare the antibody composition of human colostrum with that of bovine colostrum.

**(3)**

(b) The survival chance of a calf increases if it drinks bovine colostrum.

(i) Place a cross ☒ in the box next to the type of immunity that the colostrum will give the newborn calf.

**(1)**

☒ **A** artificial active

☒ **B** artificial passive

☒ **C** natural active

☒ **D** natural passive

(ii) Explain why colostrum increases the survival chance of a calf.

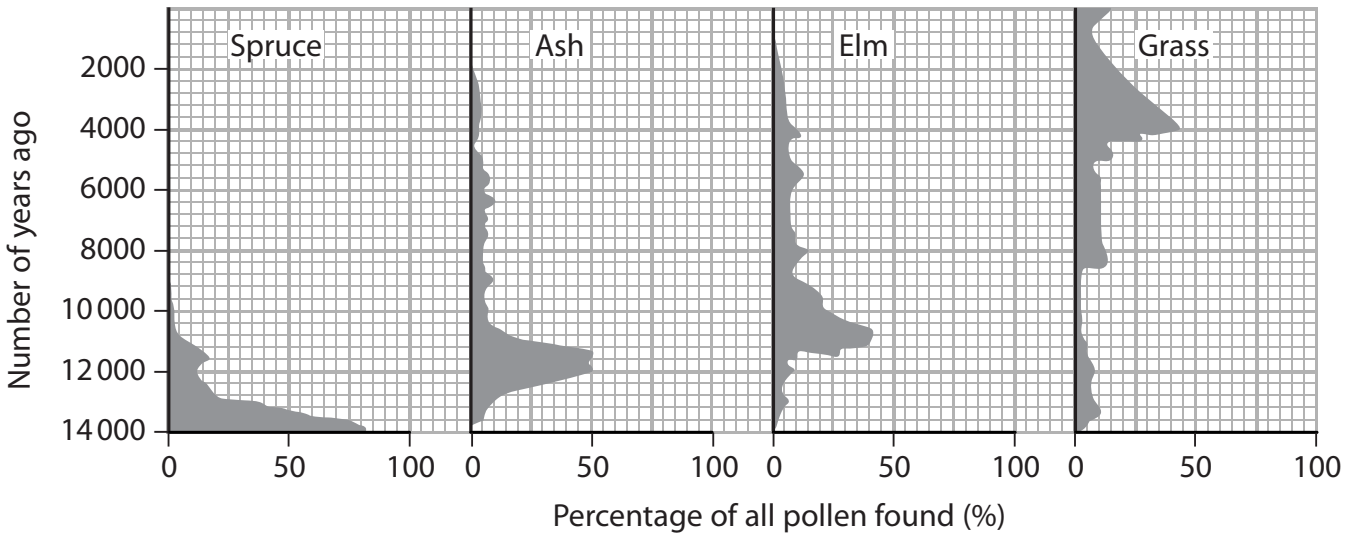
**(2)**

**(Total for Question 4 = 8 marks)**

**5** Pollen grains present in peat bogs and lake sediment may provide evidence of climate change.

(a) In an investigation, the age of the sediment in a lake was determined. The abundance of pollen grains, from four types of plant, in the lake sediment was recorded.

The results are shown in the graph below.




(i) Using the information in the graph, describe the changes in abundance of spruce, ash and elm trees over the last 14 000 years.

**(3)**

(ii) Ash and elm trees grow in wet, poorly-drained soils. Grass grows in drier conditions.

Using the information in the graph, describe the changes in climate at this lake over the last 14 000 years.

**(3)**

(iii) Explain how the information in the graph indicates that other types of plant were present around this lake.

**(2)**

(b) Explain how dendrochronology may also be used to provide evidence for climate change.

**(3)**

**(Total for Question 5 = 11 marks)**

**6** Polar bears are large, carnivorous mammals that live on the sea ice of the Arctic.

Polar bears feed on seals and hunt them from the sea ice. They hunt the seals during the seals' breeding season, when the young seals are born on the sea ice.

The hunting season ends in the late spring when the ice melts. The polar bears do not eat again until the ice reforms in the winter.

Female polar bears dig dens in the ice to give birth to their young.

The photograph below shows a polar bear and her cub.

Magnification ×0.03

The number of polar bears is decreasing as a result of starvation. This is caused by a loss of their habitat because the sea ice is melting earlier in the year.

An increase in the concentration of greenhouse gases is thought to be responsible for this loss of habitat.

(a) (i) Place a cross ☒ in the box next to the names of **two** greenhouse gases.

**(1)**

☒ **A** hydrogen and methane

☒ **B** methane and carbon dioxide

☒ **C** oxygen and hydrogen

☒ **D** water vapour and oxygen

(ii) Describe how an increase in greenhouse gases could cause the loss of sea ice.

**(3)**

(b) Suggest why the loss of sea ice could result in a decrease in the number of polar bears.

**(3)**

(c) Polar bear DNA is analysed by scientists to learn more about this animal.

A group of scientists recently extracted DNA from a polar bear footprint left in the snow. They found polar bear DNA and seal DNA.

(i) Suggest why a footprint can be used as a source of DNA.

**(1)**

(ii) Suggest **two** advantages of using DNA obtained from a footprint, rather than collecting DNA directly from a polar bear.

**(2)**

(iii) Place a cross ☒ in the box next to the method used to separate DNA.

**(1)**

☒ **A** amniocentesis

☒ **B** gel electrophoresis

☒ **C** polymerase chain reaction

☒ **D** proteomics

(iv) Suggest how the scientists could conclude that the DNA they identified came from both the polar bear and a seal.

**(2)**

**(Total for Question 6 = 13 marks)**

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**7** A biosphere is a specialised building that can be used to study living organisms in a controlled environment. A biosphere acts as a model of their natural habitat.

Microorganisms are added to the soil in the biosphere and the abiotic factors are controlled. Plants and animals are then put in the biosphere.

(a) Distinguish between the terms **environment** and **habitat**.

**(2)**

(b) Explain why microorganisms are added to the soil in the biosphere.

**(3)**

(c) In one study of a biosphere, species richness decreased. It was found that the uptake of carbon dioxide and plant productivity also decreased.

This was linked to a decrease in the use of the light energy in the biosphere.

(i) Explain the meaning of the term **species richness**.

**(2)**

(ii) Suggest why a decrease in species richness would decrease the use of light energy in the biosphere.

**(2)**

(iii) Explain why the uptake of carbon dioxide and plant productivity both decrease as species richness decreased.

**(4)**

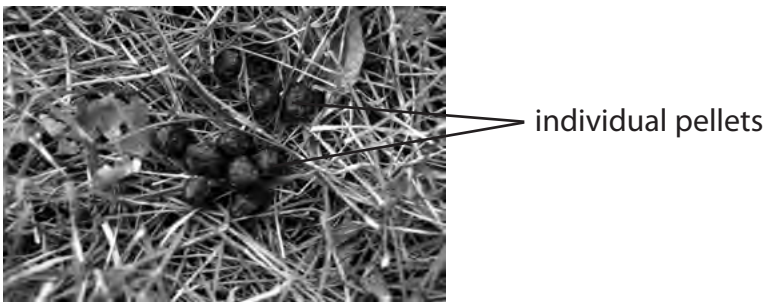
**(Total for Question 7 = 13 marks)**

**8** Mountain hares are small mammals that eat a number of species of plants.

The habitats of hares can be identified by looking for grazed plants and pellets left at feeding sites.

Pellets are small round droppings that contain undigested cellulose, left at feeding sites by mountain hares.

The photograph below shows some pellets.




Magnification ×1

(a) Describe the structure of a cellulose molecule.

**(3)**

(b) The presence of pellets in five habitats was investigated.

The table below shows the results of this investigation.

| Habitat | Percentage of quadrats containing pellets (%) |
|---|---|
| Young heather | 84 |
| Old heather | 20 |
| Wavy hair grass | 50 |
| Bilberry | 30 |
| Mat grass | 20 |

*(i) Describe how an investigation could be carried out to collect the data shown in this table.

**(5)**

(ii) State **two** conclusions that can be made from the results of this investigation.

**(2)**

(iii) Suggest the limitations of using the percentage of quadrats containing pellets as an indication of the food preferences of mountain hares.

**(3)**

**(Total for Question 8 = 13 marks)**

**TOTAL FOR QUESTION PAPER = 90 MARKS**

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